Taylor Run Stream Restoration Project

September 29, 2020

Virtual Public Engagement Meeting

Tonight's Agenda

- Why are we here?
- Background
- Development, Runoff, and Climate Change
- Why Stream Restoration?
- Introduce the Project Team
- Taylor Run Past Disturbances
- Phase III Stream Assessment
- Existing Conditions
- Design Approach
- Design Process
- Finished stream restoration project examples
- Recap
- Next Steps

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Only Rain Down the Storm Drain!

Background Timeline

- 2004 and 2006: Phase I & II Stream Assessments
- 7/1/2013: Municipal Separate Storm Sewer System (MS4) Permit
- 9/08/2015 City Council: City's *Chesapeake Bay TMDL Action Plan for 5% Compliance* (June 2015)
- 9/20/2018 Parks and Recreation Commission: DRAFT *Phase III Stream Assessment: Stream Restoration and Outfall Stabilization Feasibility Study*
- 9/24/2019 City Council: *Chesapeake Bay TMDL Action Plan for 40% Compliance*
- 12/05/2018 Public meeting: Draft *Phase III Stream Assessment*
- 9/25/2018: City Council approved the state stormwater local assistance fund (SLAF) matching grant application
- 10/05/2018: Sent SLAF application to Virginia Department of Environmental Quality (DEQ)
- 12/12/2018: DEQ visited the project site to vet project for SLAF application
- 2/2019: Final *Phase III Stream Assessment*
- 5/03/2019: SLAF matching grant authorization via letter of $2.255M

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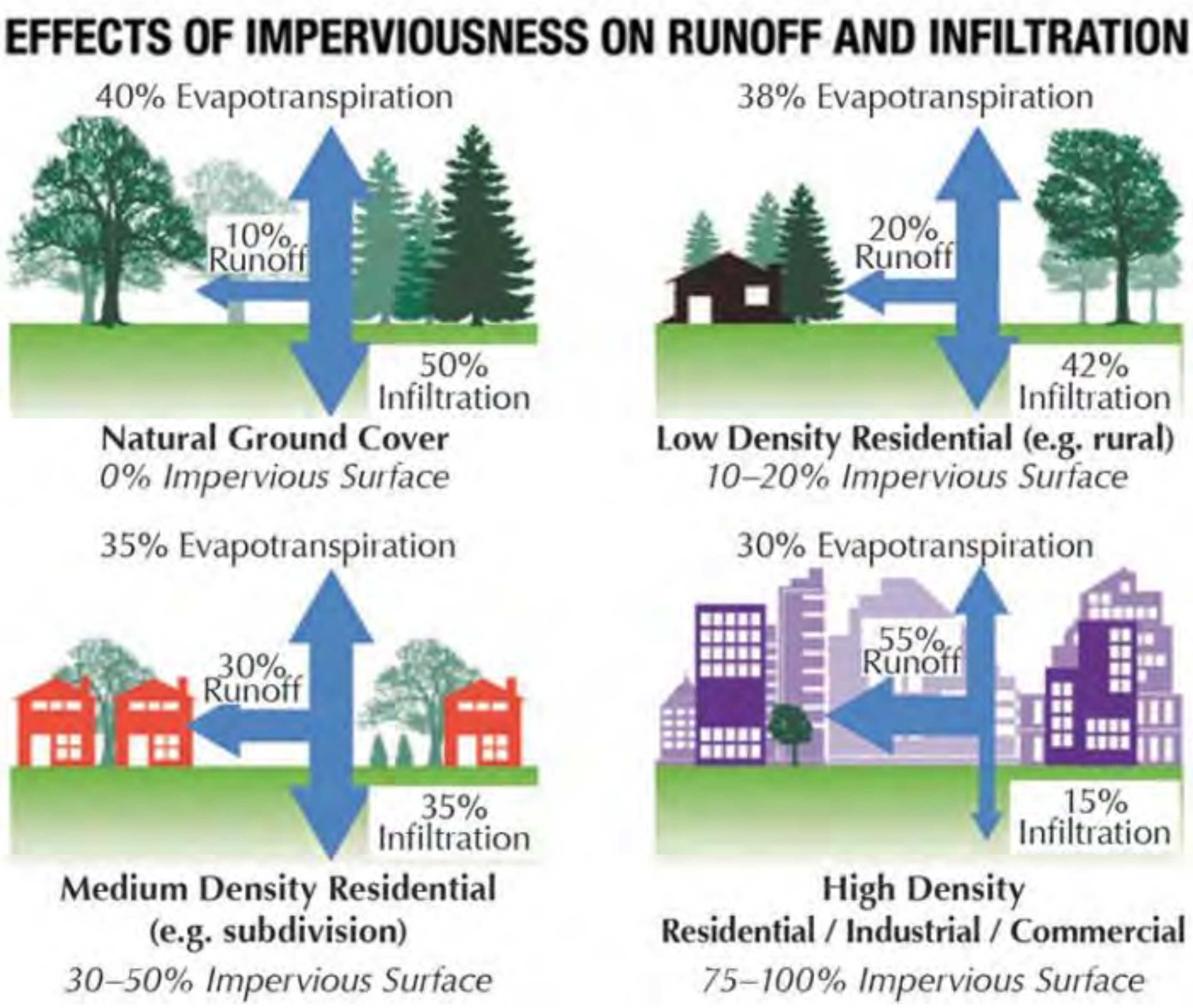
Development and Runoff

- Most development in the City occurred prior to stormwater requirements
- Redevelopment must improve stormwater runoff: **amount and quality**



Source: www.bayjournal.com

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Effects of Climate Change: More Frequent, Intense Rainfall Events

Radar, September 10

- 2018: Virginia's wettest year on record
  - 20"+ over normal
- July 8, 2019: Regional flash flood
  July 23, 2020: Local flash flood
  - 60-80% of July monthly average in 30 minutes
- August 28, 2020: Local flash flood
  - 2" in 60 minutes
- September 10: Local flash flood
  - 2.5-4" with rates up to 3"/hr in 10 mins
  - Daily rainfall record at National Airport
- Increase in reported problems of property damage

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Why Stream Restoration?

- Heavy stream flows during rainfall events
- Erosion scours stream and undermines trees on banks
- Sediment loss downstream
- Loss of stability
- Stream blockages
- Further bank erosion

Source: City of Alexandria

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Project Teams

T&ES

- Environmental Scientists
- Civil Engineers
- Planners
- Project Mangers

Consultant

- AECOM (URS)
- Wetland Studies and Solutions, Inc.

RPCA

- Naturalists
- Ecologists
- Arborists

DPI

- Project Mangers
- Engineers
- Landscape Architects

Transportation and Environmental Services = T&ES
Recreation, Parks, and Cultural Activities = RPCA
Department of Project Implementation = DPI

Spring 2017 Natural Color Imagery
Taylor Run Stream Restoration
WSSI #28006.01

NORTH

0 300 600
Feet

Original Scale:
1" = 600'

Point of Analysis
Study Area
Drainage Area
County Border

Taylor Run Project Site

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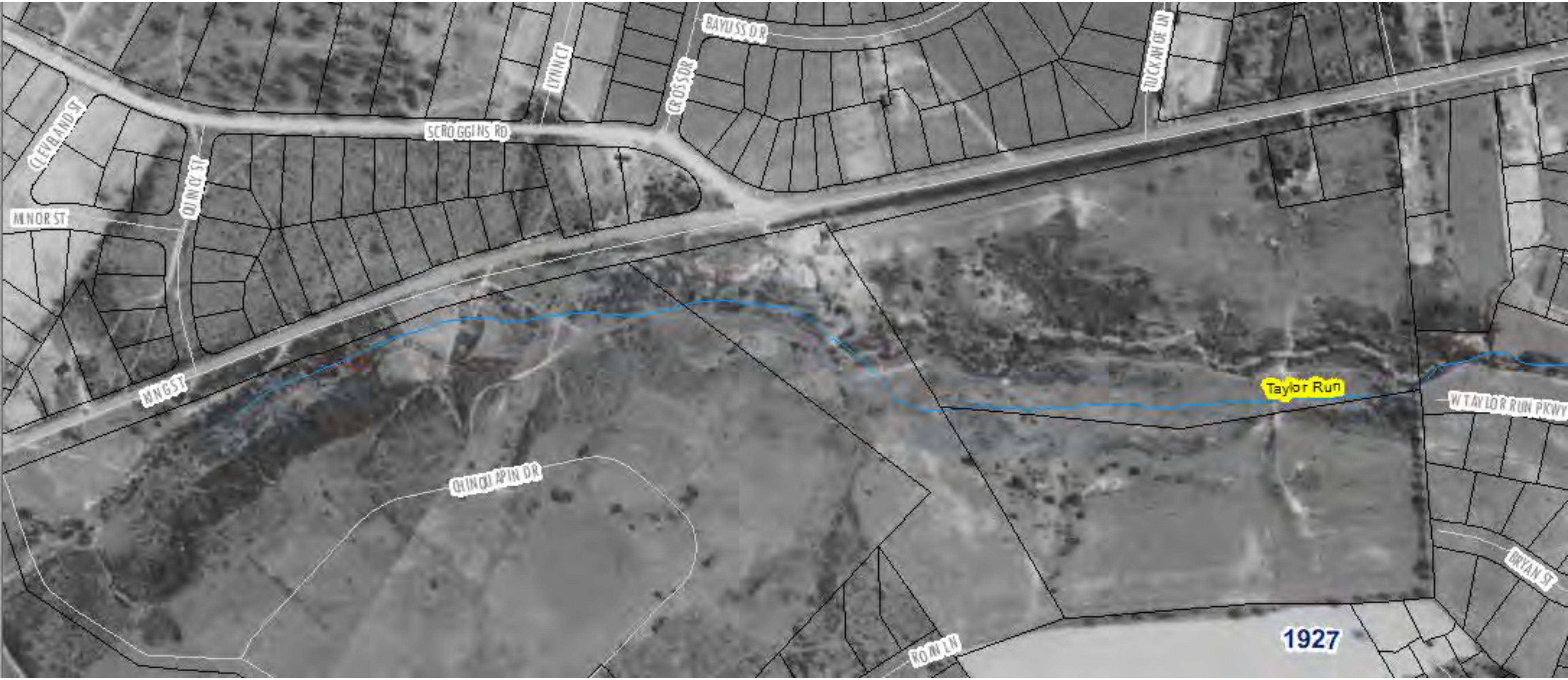
Taylor Run
Past Disturbances

- Small segment of a larger stream remains with piped headwaters and piped farther downstream
- Many disturbances over the years have impacted the entire area
- Sanitary sewer parallel and crosses the stream
- None of these disturbances were meant to restore the stream health, but nature is resilient

Changes to Taylor Run - 1927



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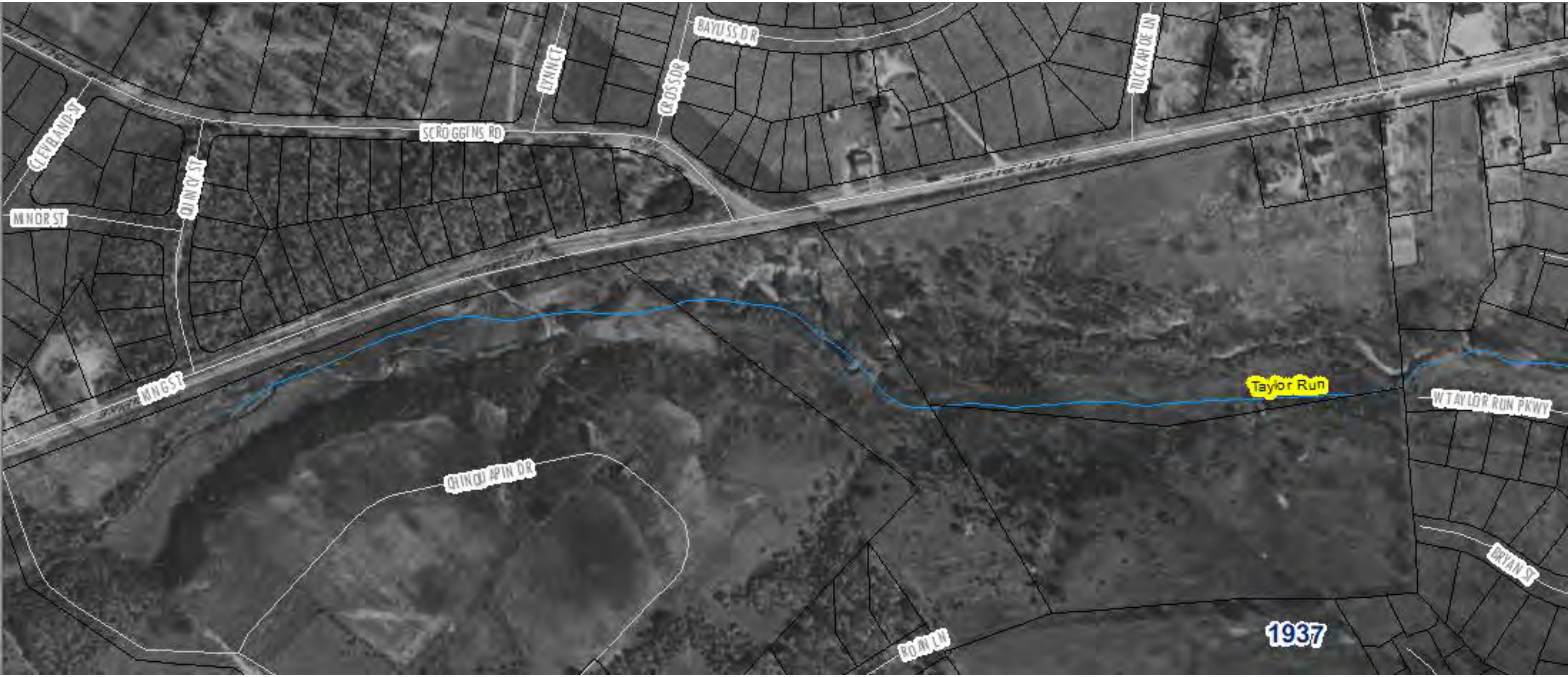
Changes to Taylor Run - 1937



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Changes to Taylor Run - 1949

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Changes to Taylor Run - 1959

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Changes to Taylor Run - 1964

Changes to Taylor Run - 2019

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Stream Assessment Program

2004 2008 2018

TIMELINE

Phase I

Stream Categorization

Mapping of streams, defining limits, and stream categorization

Phase II

Assessment of Streams

Stream habitat, infrastructure impacts, problem area, characteristics

Phase III

Project Identification

Potential project sites evaluated and ranked. Conceptual designs for top projects.

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Stream Restoration Goals and Objectives

- Identify stream resources
- Restore Healthy Stream Characteristics
- Improve the City's waterways and ecology
- Reduce pollution to the Bay
  - Nitrogen, phosphorus and sediment
- Protect and stabilize infrastructure
- Consistent with the Environmental Sustainability Strategic Goal
- Meet state and federal mandates

Phase III Stream Assessment: Site-Specific Data

- City's Phase III Stream Assessment (Feb 2019)
  - Identify and prioritize
  - Priority projects: Taylor Run and Strawberry Run stream restorations
  - City must follow using Expert Panel "protocols"
- Restore to healthy stream characteristics
  - Lower flows allow benthic macroinvertebrates (aquatic insects) to thrive
  - Mitigate tree loss from bank undercutting
  - Stabilize banks to reduce erosion
  - Avoid wetland impacts
  - Remove concrete rubble
- Protect Sanitary Sewer infrastructure

Field Assessment

- BANCS assessment
- Bulk Density
- Mobile Data Collection

wood.

Alexandria Stream Assessment

Section 1 - General Information

Site Name	000109 Holmes Run
Project Type	Outfall
Site Latitude	38.83065
Site Longitude	-77.13487
Date	03/15/2018
Staff	Troy Biggs; Mike Hepp; Alexandria Staff; Other
Watershed	Holmes Run
Drainage Area	49.5 ac.

Section 2 - Field Photos

Image 1

From outfall towards Holmes Run

Section 4 - Channel

CHANNEL GEOMETRY

30 ft

8 ft

10

CHANNEL FEATURES

3

G1 / G4

Aggrading

Degrading

Riffles

Pools

Runs

Other

annel Bars

Decision Matrix and Ranking

Number	Ranking Criteria
1	Channel Dimension at Bankfull Cross-Section
2	Channel Planform Pattern
3	Channel Bed Longitudinal Profile
4	Streambank Stability and Protection from Erosion
5	Presence of Urbanite
6	Channel Obstructions
7	Riparian Vegetation
8	Presence of desirable fish and wildlife
9	Environmentally Sensitive Areas
10	Impacts to Trees
11	Construction Access
12	Property Ownership
13	Utility Conflicts
14	Stakeholders
15	Historically Sensitive Areas
16	Public Education and Outreach
17	Recreation Potential
18	Infrastructure at Risk
19	Public Safety Concerns
20	Associated Infrastructure Project Opportunity
21	Cost per lb. of Phosphorous Removal Interim Rate
22	Cost per lb. of Phosphorous Removal BANCS Model
23	MS4 Draining to Project Site
	Total

wood.

PROJECT COMPARISON DECISION MATRIX CRITERIA & SCORING

Criteria Scoring: Scores range from 1 to 5 and values increase from left to right. Higher score indicates greater restoration potential and expected benefit(s).

I. **CHANNEL BED & BANK STABILITY**

1. **Channel Dimension at Bankfull Cross-Section**

Channel dimension is the cross sectional shape of the channel, including channel width, depth, and cross sectional area. The bankfull discharge is considered to be the most effective flow for moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphological characteristics of channels (*Dunne and Leopold, 1978*). Research indicates that the hydraulic geometry substantially increases for urban streams in comparison to rural streams (*Doll et al., 2003*). Channel Evolution Model (CEM – *Schumm & Parker, 1973*) is an approach to explain the complexity of a fluvial system. A fluvial system is constantly changing and evolving, which is the systems attempt to reach equilibrium. A system that is considered stable or in equilibrium is well vegetated, frequently interacts with its floodplain and the sediment is suspended. CEM is used to classify the current stage of the system in order to predict how the system will evolve. Knowing the current stage of a system is incredibly beneficial when alterations to a system are being considered, especially when those alterations are aimed to provide restoration.

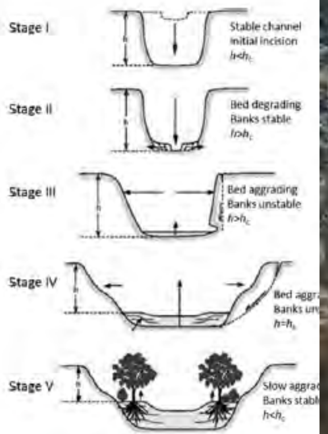

Figure 1. Channel Evolution Model

(1) Good: Stage I or V of Channel Evolution Model	(3) Fair: Stage IV of Channel Evolution Model	(5) Poor: Stage II or III of Channel Evolution Model.

5. **Presence of Urbanite**

Urbanite is defined as large broken pieces of concrete, such as curb and gutter. It is frequently placed in streams City as an attempt to prevent erosion and increase stability. While, it may be helpful in a few instances, overa detrimental to the stream and provides poor instream and riparian habitat.

(1) Low: Only natural materials observed. No presence of urbanite located throughout the reach	(3) Moderate: moderate presence of urbanite materials found in 1 or 2 locations throughout the channel.	(5) High: extensive presence of urbanite indicated by greater than 3 locations throughout the entire channel length

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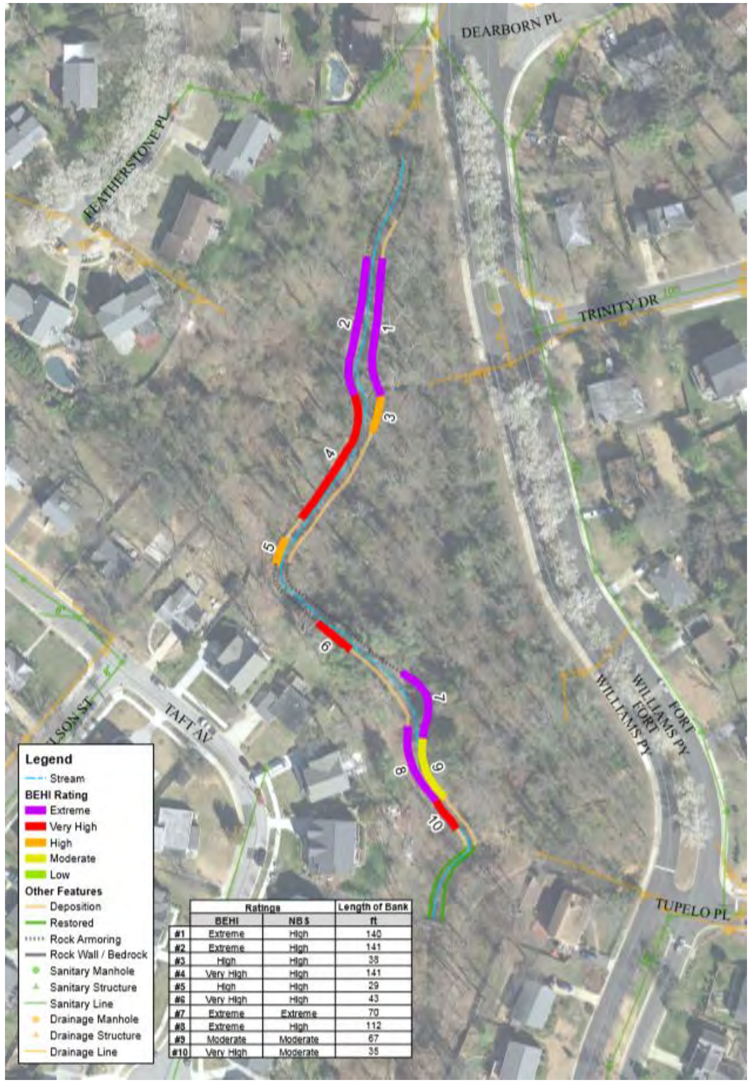
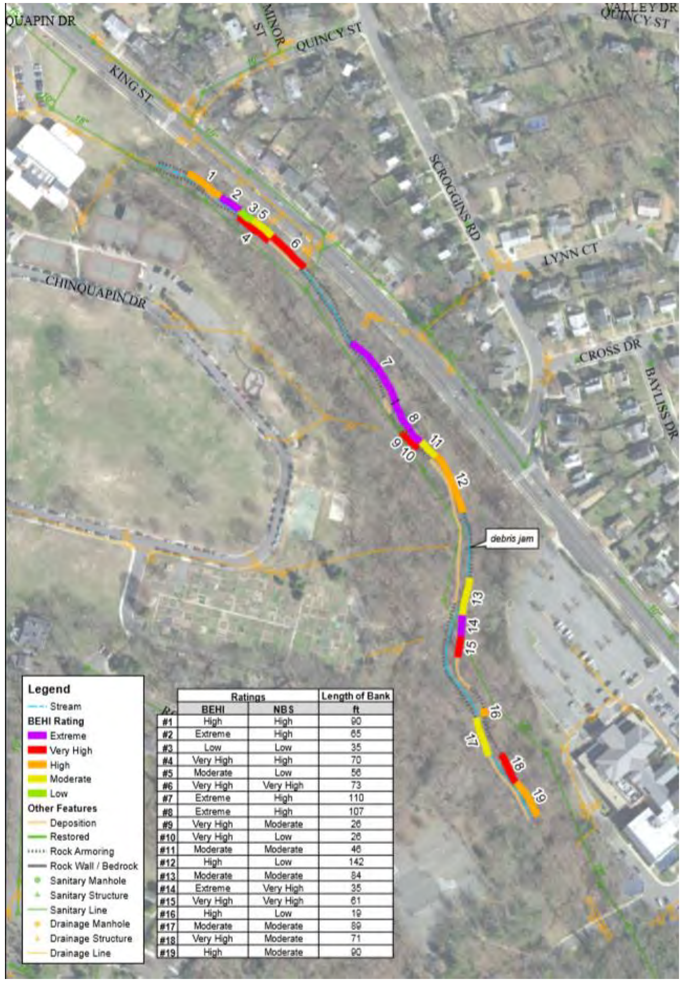
Project Team – Phase III Stream Restoration



	Ratings		Length of Bank
	BEHI	NBS	ft
#1	Extreme	High	140
#2	Extreme	High	141
#3	High	High	38
#4	Very High	High	141
#5	High	High	29
#6	Very High	High	43
#7	Extreme	Extreme	70
#8	Extreme	High	112
#9	Moderate	Moderate	67
#10	Very High	Moderate	35



	Ratings		Length of Bank
	BEHI	NBS	ft
#1	High	High	90
#2	Extreme	High	65
#3	Low	Low	35
#4	Very High	High	70
#5	Moderate	Low	56
#6	Very High	Very High	73
#7	Extreme	High	110
#8	Extreme	High	107
#9	Very High	Moderate	26
#10	Very High	Low	26
#11	Moderate	Moderate	46
#12	High	Low	142
#13	Moderate	Moderate	84
#14	Extreme	Very High	35
#15	Very High	Very High	61
#16	High	Low	19
#17	Moderate	Moderate	89
#18	Very High	Moderate	71
#19	High	Moderate	90

Taylor Run Project

- Chinquapin Rec Center Outfall to First Baptist Church
- About 1,900 feet in length
- Sanitary Sewer stabilization
- Wetland and habitat protection/enhancement
- Mitigate tree impacts
- Proposed Construction: Fall 2021 start
  - 12 months: 6 construction, 6 restoration

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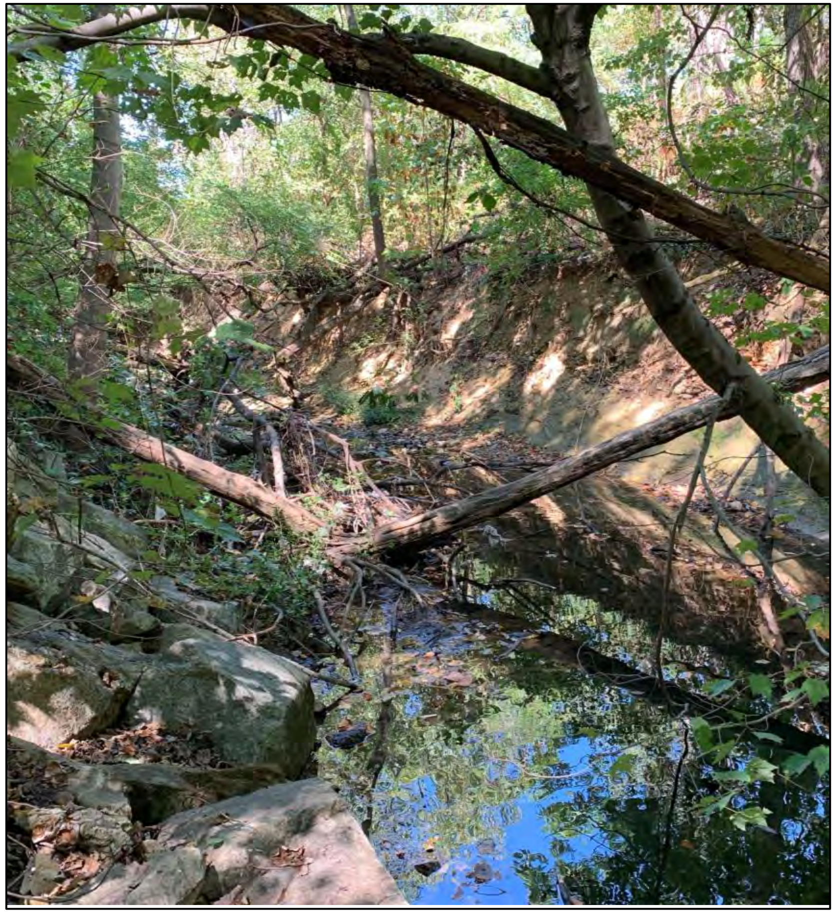
Photos by Wood & WSSI



Taylor Run - Existing Conditions

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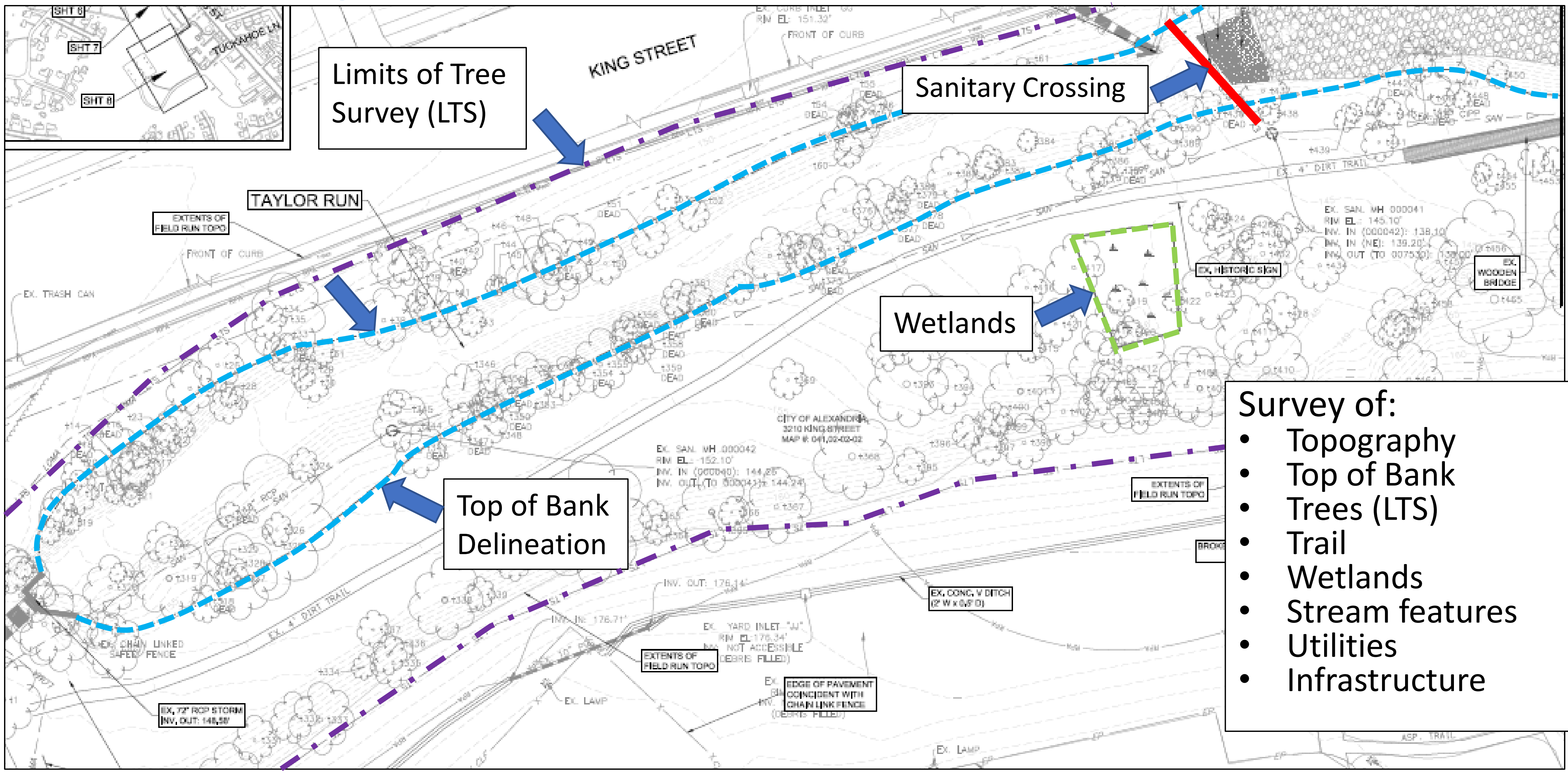
Existing Conditions

Photos by Wood and WSSI

Existing Conditions – Field Work



Survey of:

- Topography
- Top of Bank
- Trees (LTS)
- Trail
- Wetlands
- Stream features
- Utilities
- Infrastructure

Existing Conditions - Sanitary

Photos by WSSI

Existing Conditions - Sanitary

Photos by WSSI

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Existing Conditions – Wetlands

Survey of:
- Topography
- Top of Bank
- Trees (LTS)
- Trail
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- Stream features
- Utilities
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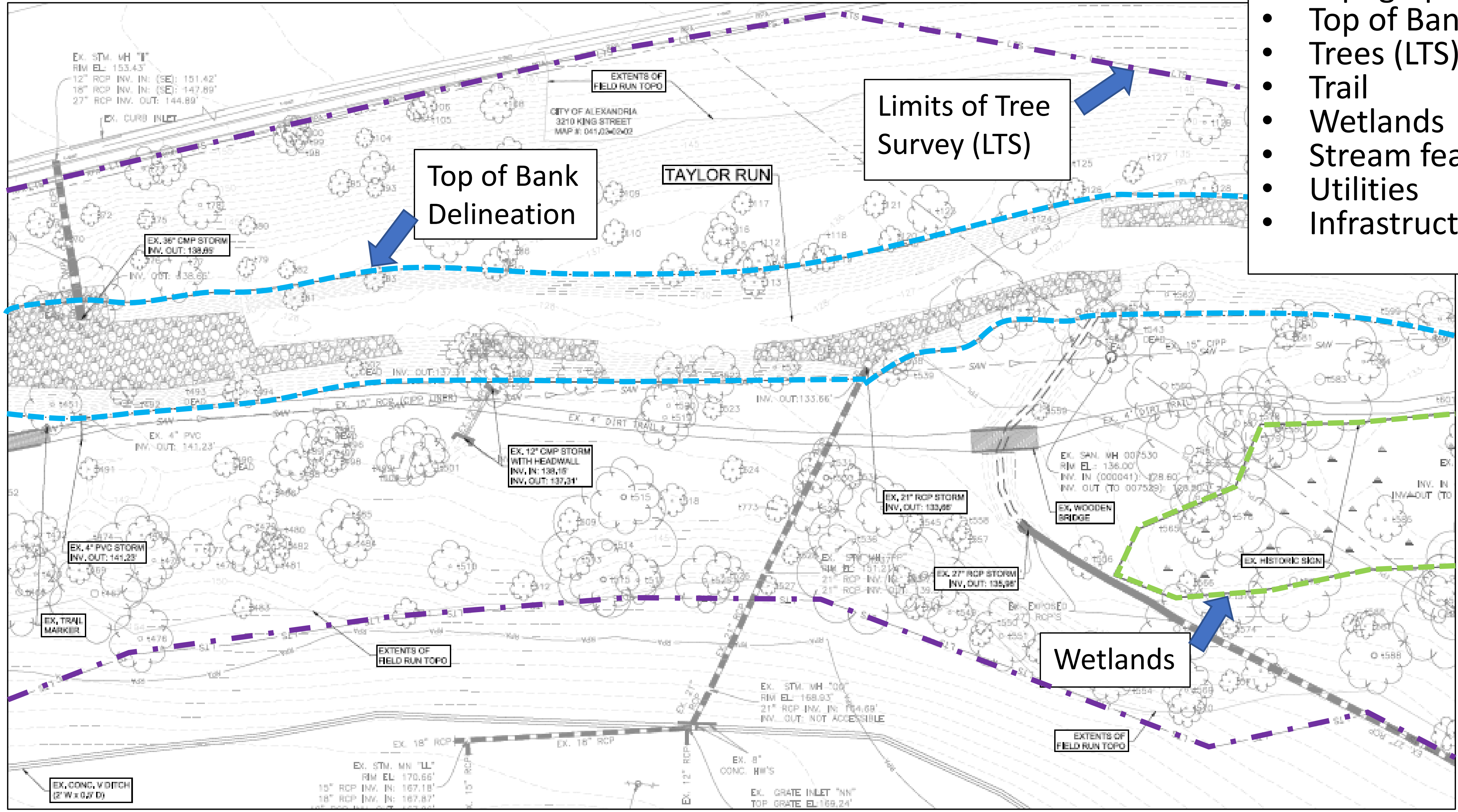

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Existing Conditions - Wetlands

Photos by WSSI and AECOM

Restoration Science

- Chesapeake Bay Program effort: numerous iterations and approval committees
- Environmental scientists, civil engineers, ecologists, naturalists, private industry, academia, local government, environmental groups, non-profits
- Panel reviewed >100 studies leading to development of Nutrient Removal Protocols
- Comprehensive design for long-term stream health and co-benefits
- Natural design techniques
- Site-specific assessment

Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects

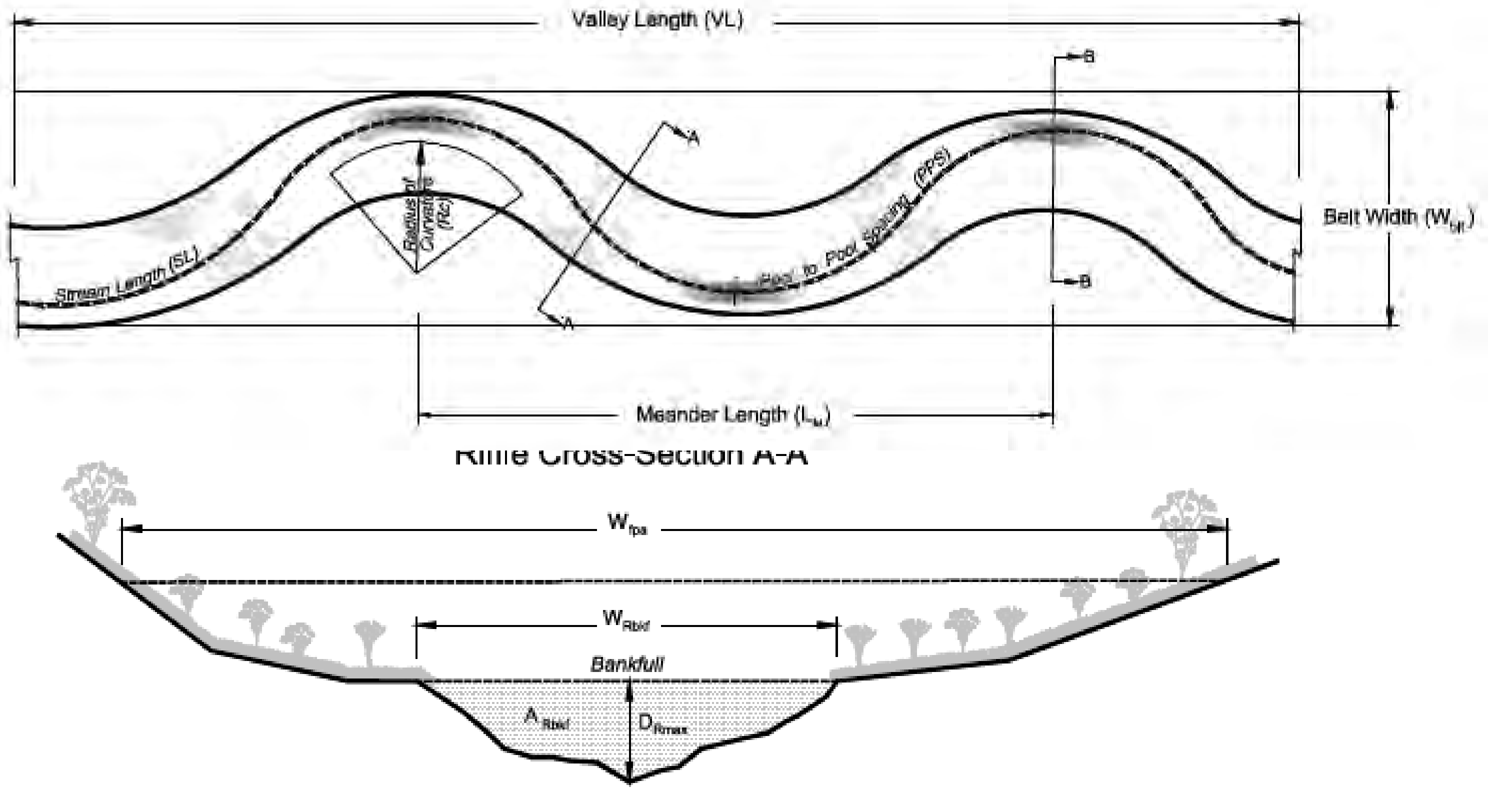
Joe Berg, Josh Burch, Deb Cappuccitti, Solange Filoso, Lisa Fraley-McNeal, Dave Goerman, Natalie Hardman, Sujay Kaushal, Dan Medina, Matt Meyers, Bob Kerr, Steve Stewart, Bettina Sullivan, Robert Walter and Julie Winters

Accepted by Urban Stormwater Work Group (USWG): **February 19, 2013**
Approved by Watershed Technical Work Group (WTWG): **April 5, 2013**
Final Approval by Water Quality Goal Implementation Team (WQGIT): **May 13, 2013**
Test-Drive Revisions Approved by the USWG : **January 17, 2014**
Test-Drive Revisions Approved by the WTWG: August 28, 2014
Test-Drive Revisions Approved by the WQGIT: September 8, 2014

Prepared by:
Tom Schueler, Chesapeake Stormwater Network
and
Bill Stack, Center for Watershed Protection

Natural Channel Design

- Based on study of stable natural systems
- Seeks to re-establish floodplain connection
- Mimics natural stream features and dimensions
- Utilizes grading/vegetation, not hardening practices



- Regional Curves – channel size relationships based on study of stable natural streams

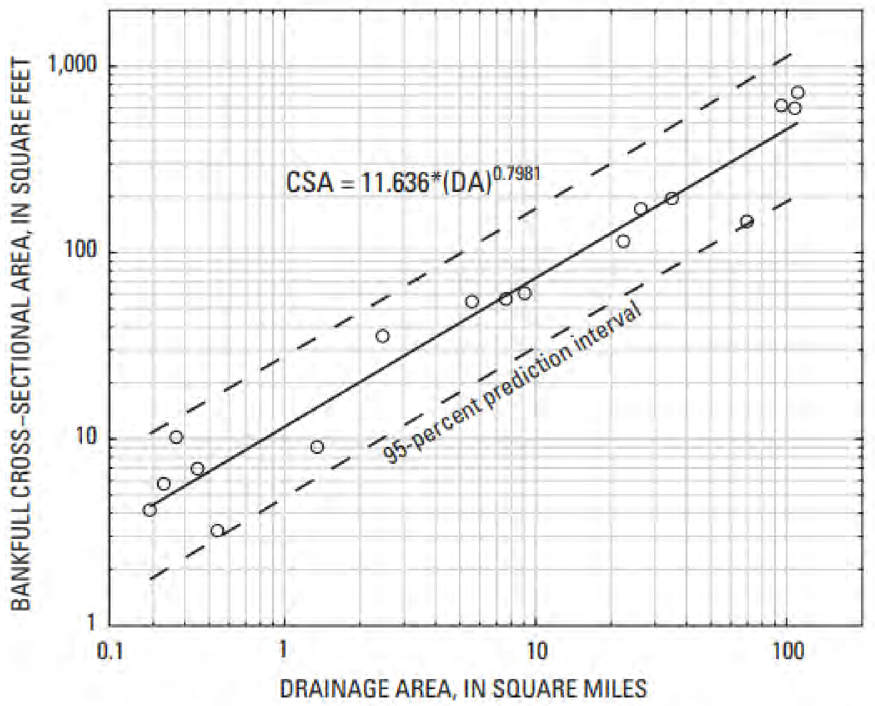


Figure 3. Regional curve relating bankfull cross-sectional area (CSA) to drainage area (DA) for non-urban streams in the Piedmont Physiographic Province in Virginia.

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Natural Channel Design - Techniques

Riffle with Log Sills

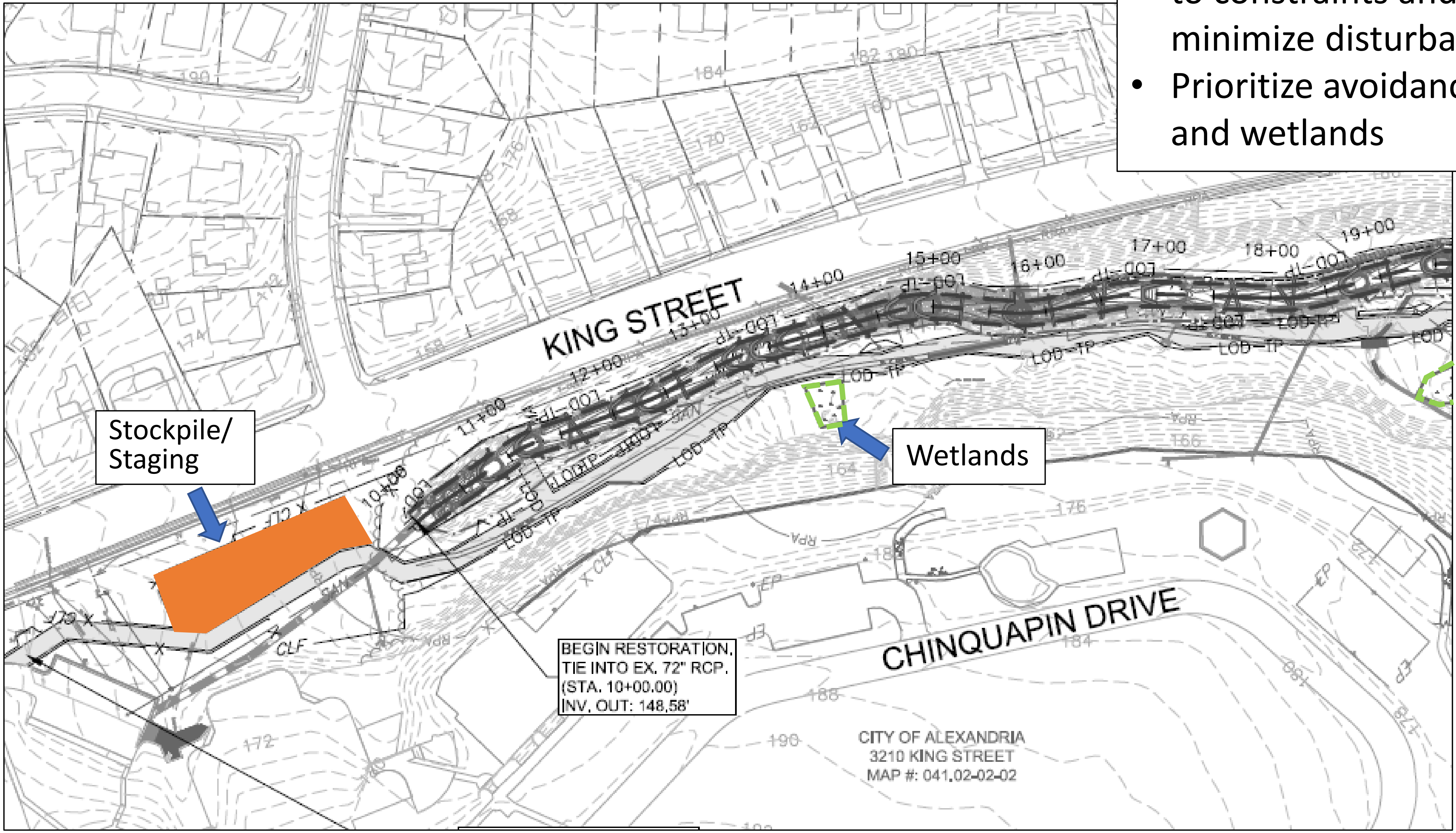
Step-Pools

Cascade

Rock/ Log Vane

Overall Design Strategy

- Utilize existing channel (due to constraints and desire to minimize disturbance)
- Prioritize avoidance of trees and wetlands



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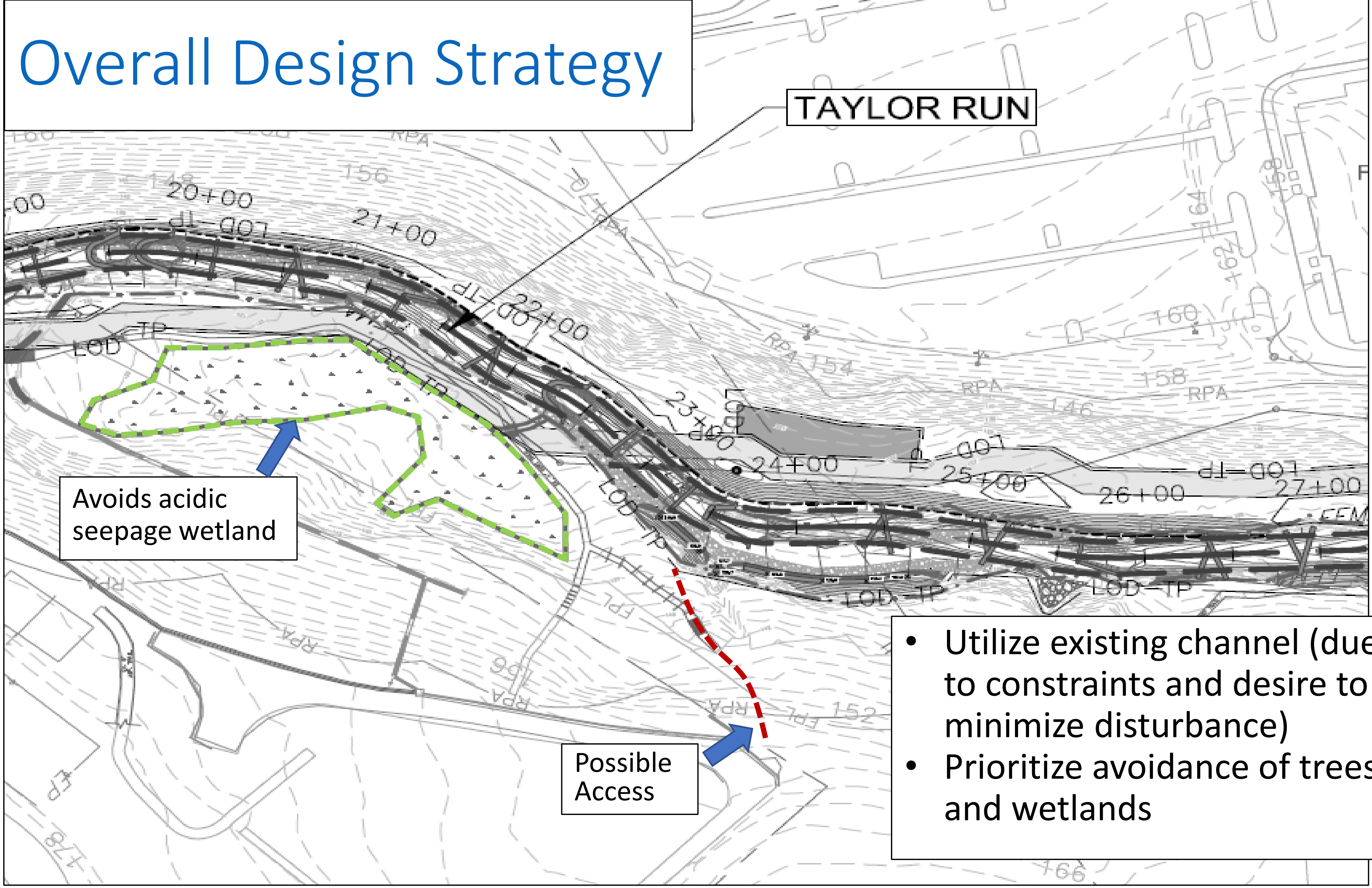
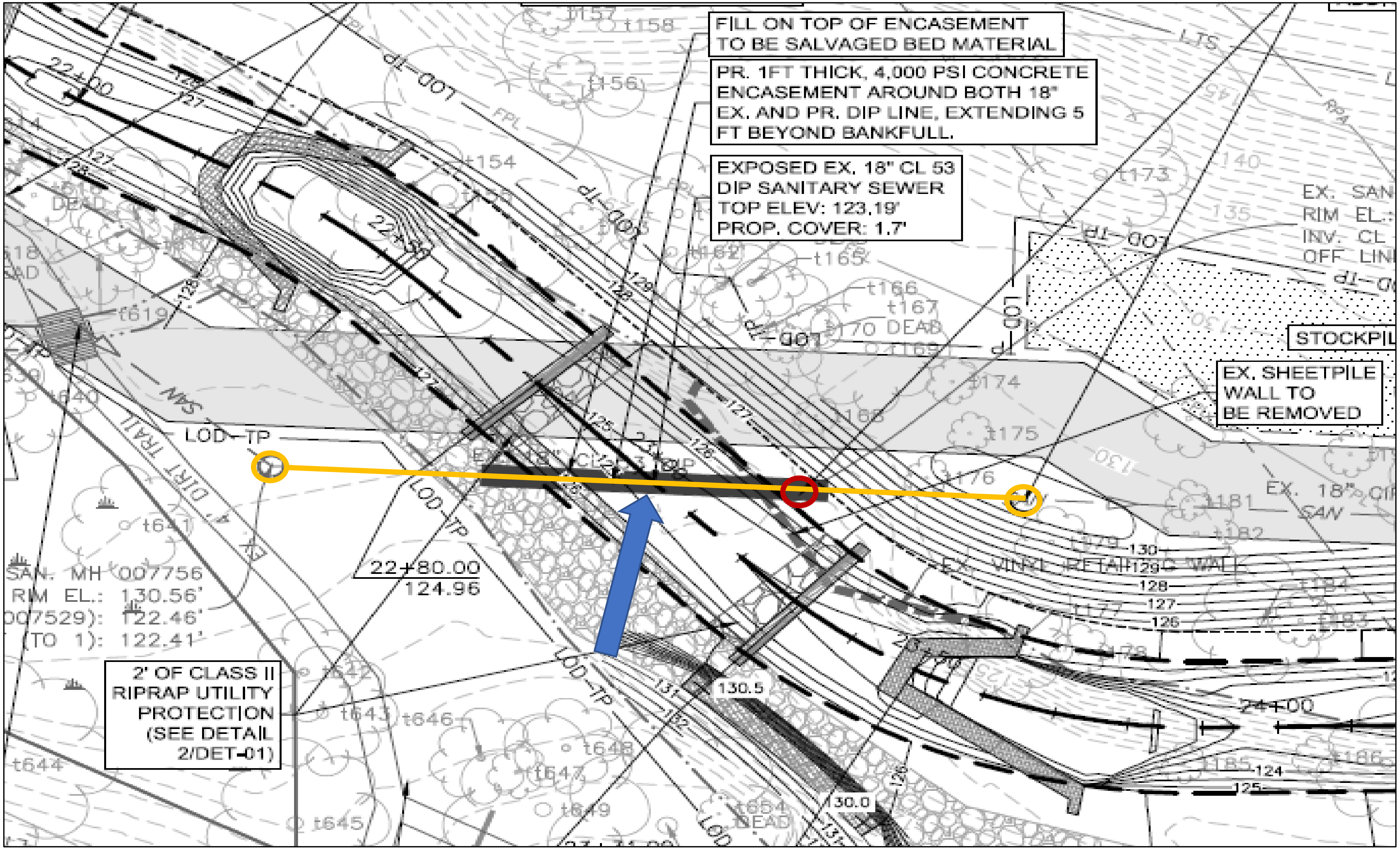
Overall Design Strategy

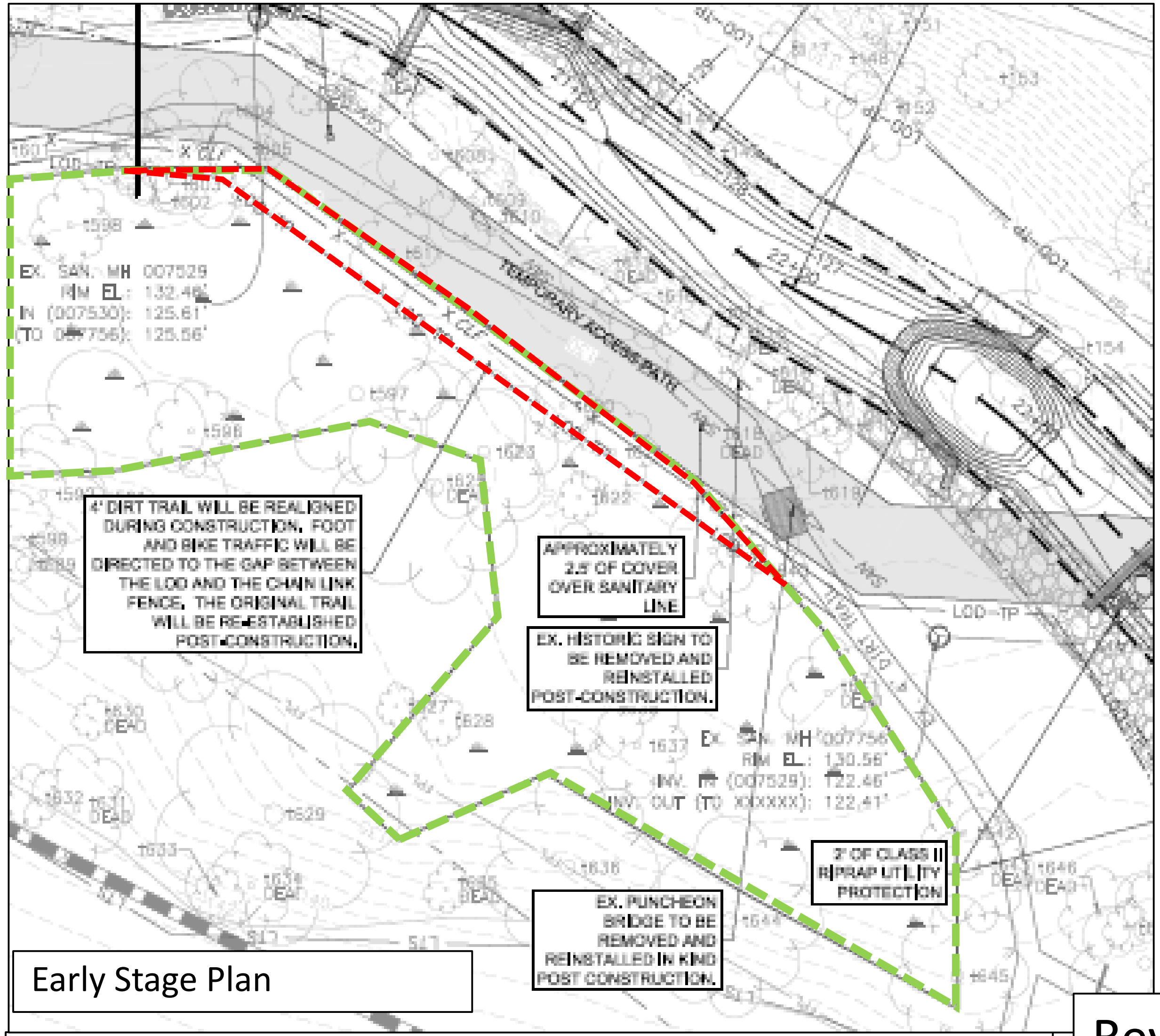


- Utilize existing channel (due to constraints and desire to minimize disturbance)
- Prioritize avoidance of trees and wetlands

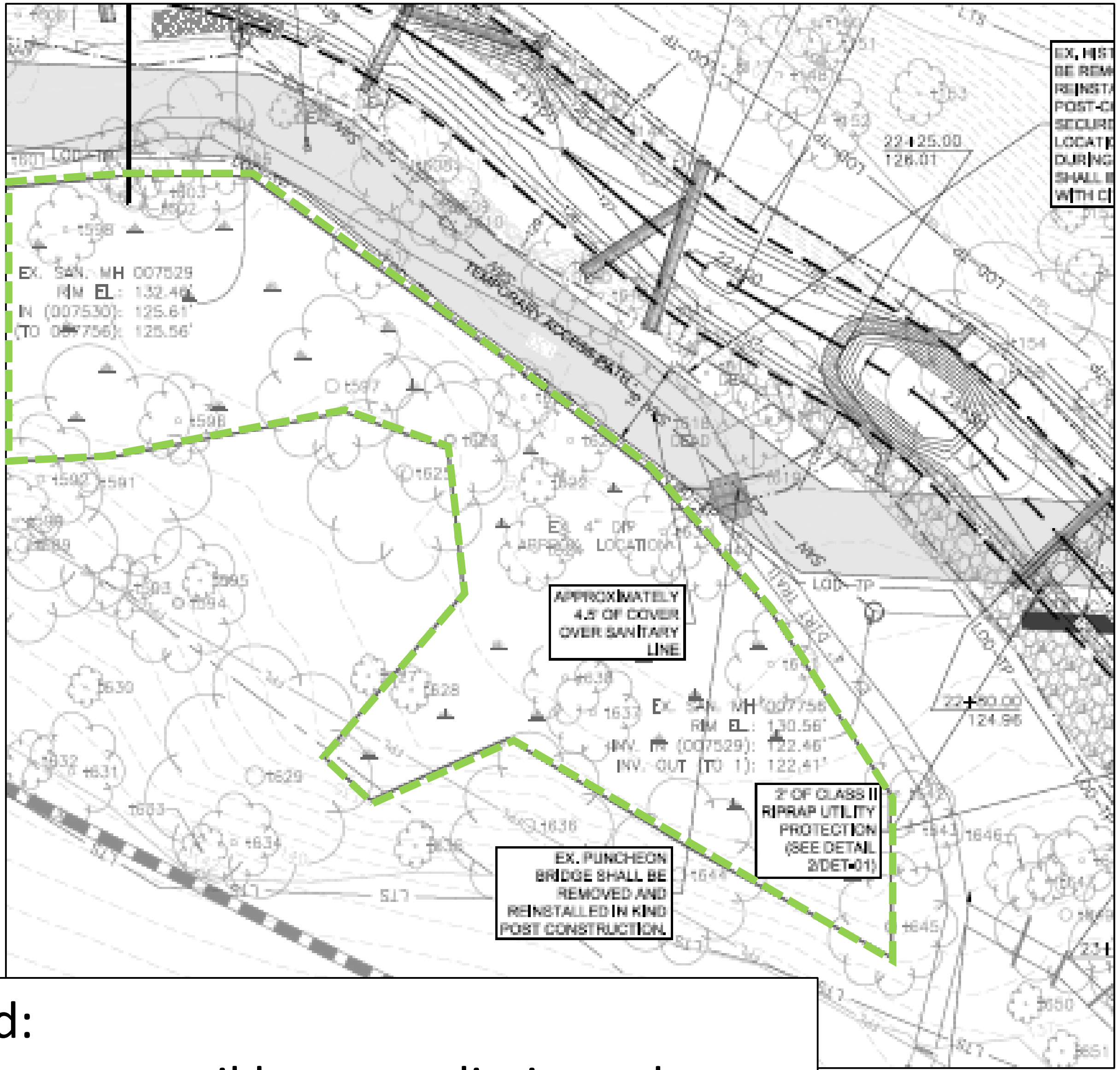
Protect Sanitary Sewer Infrastructure



Plan Iterations – Avoid Wetland Impact



Early Stage Plan



Original:

- Temporary trail considered

Revised:

- Temporary trail by-pass eliminated to avoid impact to Acidic Seepage Swamp

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Tree Impacts

		Location
Total Trees Surveyed	750	Overall Project
Total Impacted	269	Within the limits of disturbance (LOD)
Dead Trees Impacted	61	Within LOD
Live Trees Impacted	208	Within the LOD
Live Trees Impacted	124	Within Top of Stream Bank[1]
Live Trees Impacted	84	Within Access Road[2]

1. *In jeopardy of dying if stream not restored and allowed to continue to degrade. Evident from the many trees that have already fallen into the stream*
2. *Existing sanitary sewer infrastructure easement, and regrading and stockpile area. Trees are not desirable within a sanitary sewer infrastructure easement, as root growth can damage the pipe infrastructure and affect service delivery.* Coincides with trail on west/south side.

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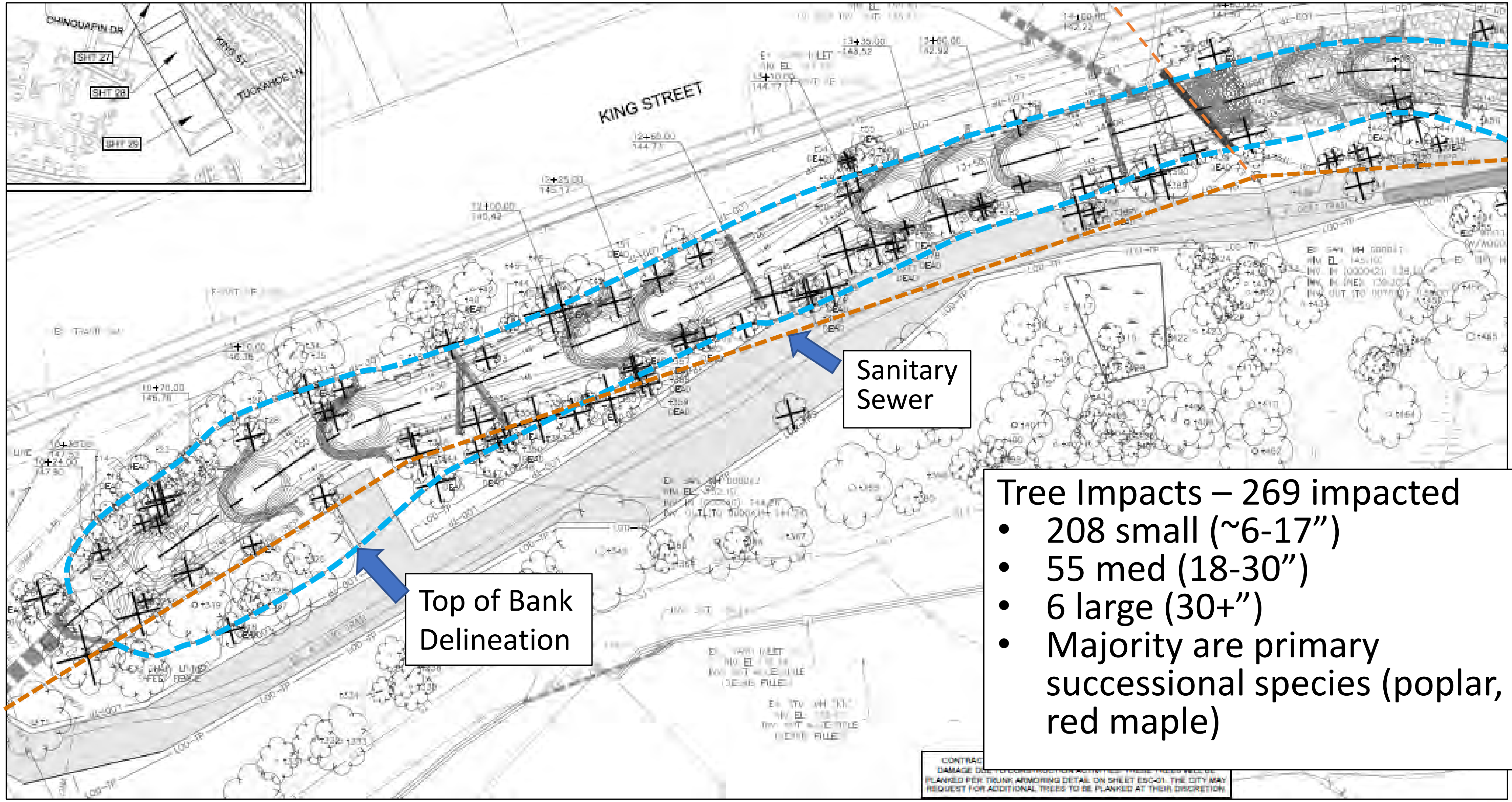
Existing Conditions – Trees






Tree Impacts – Breakdown Based on Size



Tree Impacts – 269 impacted
- 208 small (~6-17”)
- 55 med (18-30”)
- 6 large (30+”)
- Majority are primary successional species (poplar, red maple)

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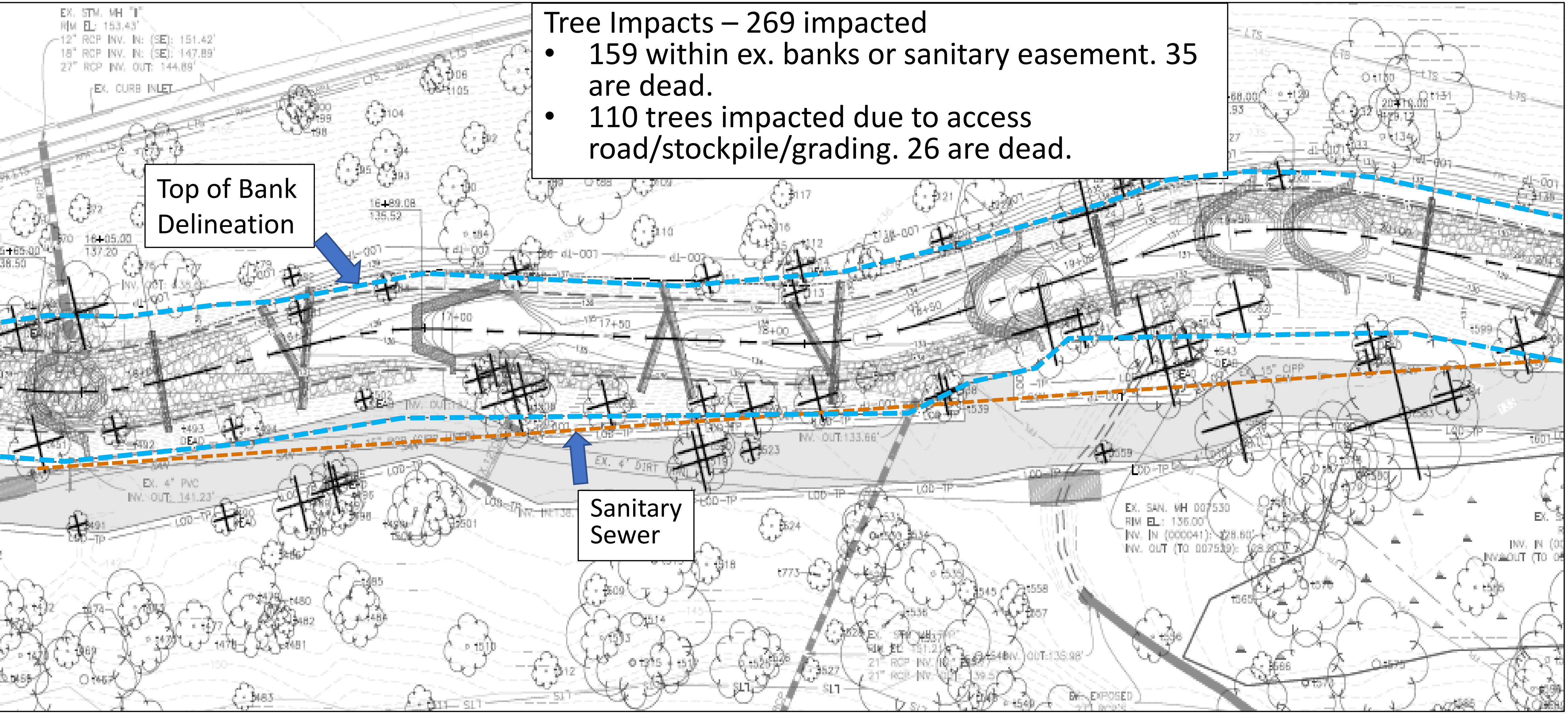
Tree Impacts – Based on Location (1)

Tree Impacts – 269 impacted

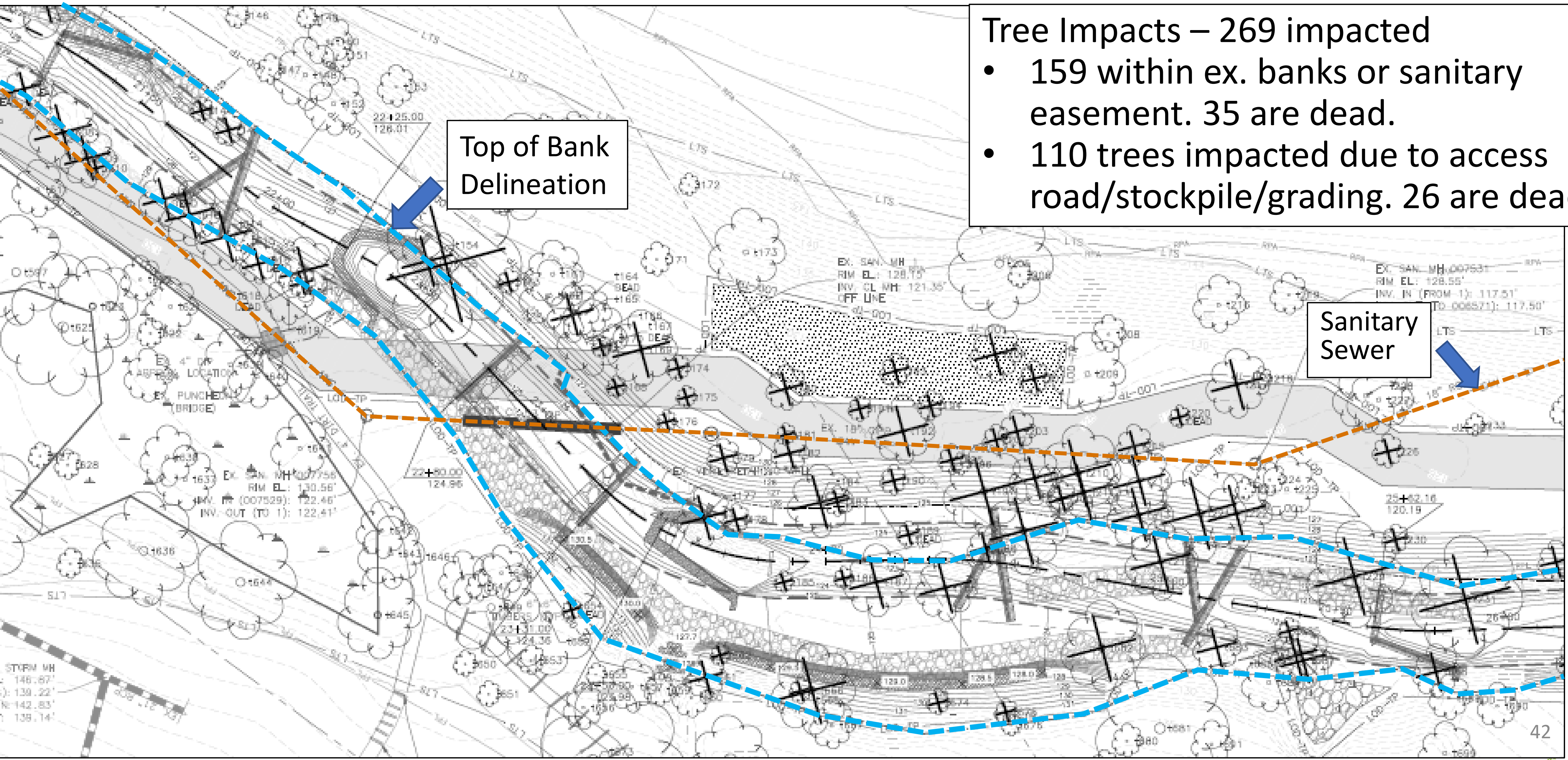
- 159 within ex. banks or sanitary easement. 35 are dead.
- 110 trees impacted due to access road/stockpile/grading. 26 are dead.



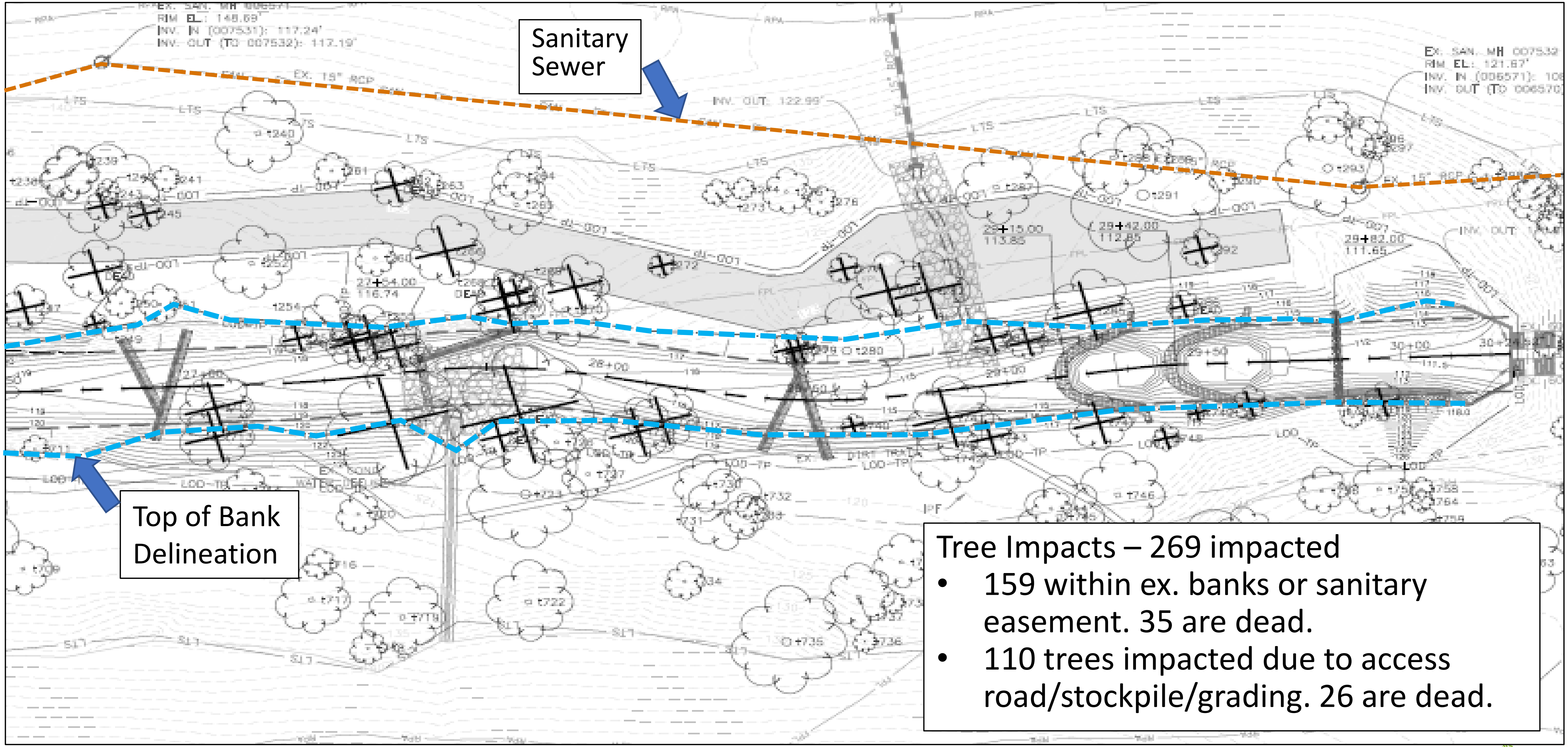
Tree Impacts – Based on Location (2)

Tree Impacts – 269 impacted

- 159 within ex. banks or sanitary easement. 35 are dead.
- 110 trees impacted due to access road/stockpile/grading. 26 are dead.



Tree Impacts – Based on Location (3)



Tree Impacts – 269 impacted

- 159 within ex. banks or sanitary easement. 35 are dead.
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Proposed Riparian Plantings

Category	Number	Variety/Diversity	Size
Overstory Trees	764	11 different native species	1-gal container
Understory Trees	1,516	6 different native species	1-gal container
Trailside Trees	55	Oak, maple, gum	1.5 – 2” diameter
Shrub Layer	7,836	13 native species	1-gal container, tubelings, live stakes

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Riparian Plantings

Summary of Impacts

- 269 surveyed trees impacted – 208 live, 61 dead
- 118 of the impacted trees are fast growing tulip poplar or red maple on or near top of bank

Summary of Replanting Effort

- Reseeding with more than 30 native species
- Plantings include **10,935** native trees and shrubs
- Dense re-growth expected in first 3 years
- Post-construction monitoring includes invasive control
- Proposed plans require contractor to meet 85% survival on B&B, container, and tubelings and 60% on bare root/tuber stock
- Size of planting stock prevents post-construction damage during high water events

Snakeden Branch – Reach 12

Before

After
(5-yr Post-con)

Courtesy of Wetland Studies and Solutions, Inc.

Arlington National Cemetery

Before

After
(3-mo Post-con)

Courtesy of Wetland Studies and Solutions, Inc.

Towne Branch

Before

After
(1-yr Post-con)

Courtesy of Wetland Studies and Solutions, Inc.

Towne Branch

Before

After

(1-yr Post-con)

Courtesy of Wetland Studies and Solutions, Inc.

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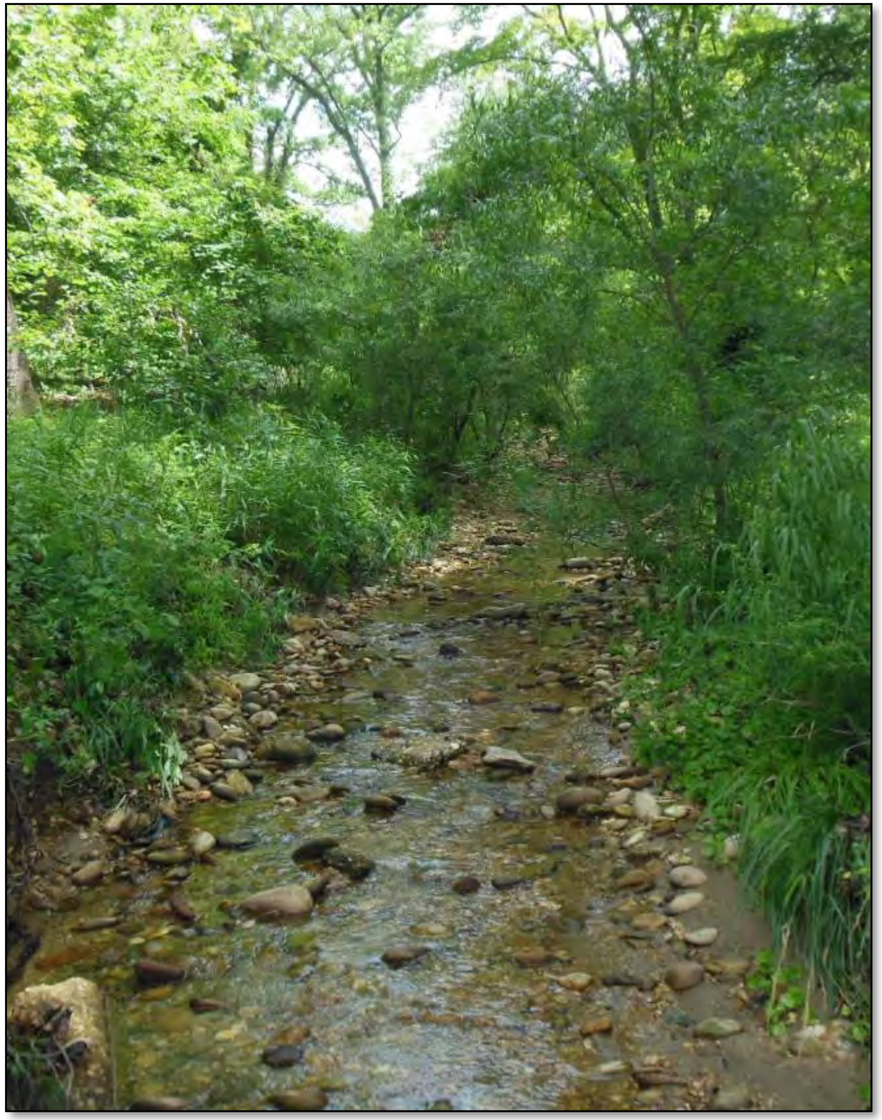
Strawberry Run – Downstream Project

Before



After

Recap

Project Identification

- Restoration to reverse past harm and protect against future impacts
  - Builds a foundation for future resiliency
- Phase III Stream Assessment and decision matrix prioritization

Project Goals

- Stable banks and channel (reduced erosion)
- Invasive non-native plants removed, and native plants re-established
- Improve the City's waterways and ecology
- Protect and stabilize infrastructure
- Consistent with the City's Environmental Sustainability Strategic Goal
- Restore Healthy Stream Characteristics

Next Steps

- 21-day project comment period through October 23
  - Use online Survey Monkey
  - Staff will create a comment/response table
  - Comments posted here will be captured
- Incorporate design changes from feedback
- Continue public engagement
- Updates to website / FAQs
- Next public meeting in November